



High power cycling capability  
Low on-state and switching losses  
Designed for traction and industrial applications

## Phase Control Thyristor Chip Type TG90-2000-52

|                                                       |            |                  |               |      |
|-------------------------------------------------------|------------|------------------|---------------|------|
| Maximum allowable mean on-state current <sup>1)</sup> |            | I <sub>TAV</sub> | 2000 A        |      |
| Repetitive peak off-state voltage                     |            | V <sub>DRM</sub> | 4600...5200 V |      |
| Repetitive peak reverse voltage                       |            | V <sub>RRM</sub> |               |      |
| Turn-off time                                         |            | t <sub>q</sub>   | 800 μs        |      |
| V <sub>DRM</sub> , V <sub>RRM</sub> , V               | 4600       | 4800             | 5000          | 5200 |
| Voltage code                                          | 46         | 48               | 50            | 52   |
| T <sub>j</sub> , °C                                   | -60...+125 |                  |               |      |

### MAXIMUM ALLOWABLE RATINGS

| Symbols and parameters |                                                                        | Units            | Values                                   | Test conditions                                                                                                                                          |                                                                                                                                                                                                  |
|------------------------|------------------------------------------------------------------------|------------------|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ON-STATE               |                                                                        |                  |                                          |                                                                                                                                                          |                                                                                                                                                                                                  |
| $I_{TAV}$              | Maximum allowable mean on-state current <sup>1)</sup>                  | A                | 2000<br>2322<br>2818                     | $T_c=93^{\circ}C$ , Double side cooled<br>$T_c=85^{\circ}C$ , Double side cooled<br>$T_c=70^{\circ}C$ , Double side cooled<br>180° half-sine wave; 50 Hz |                                                                                                                                                                                                  |
| $I_{TRMS}$             | RMS on-state current <sup>1)</sup>                                     | A                | 3140                                     | $T_c=93^{\circ}C$ , Double side cooled<br>180° half-sine wave; 50 Hz                                                                                     |                                                                                                                                                                                                  |
| $I_{TSM}$              | Surge on-state current <sup>1)</sup>                                   | kA               | 35.0<br>40.0                             | $T_j=T_{j\max}$<br>$T_j=25^{\circ}C$                                                                                                                     | 180° half-sine wave;<br>$t_p=10\text{ ms}$ ; single pulse;<br>$V_D=V_R=0\text{ V}$ ;<br>Gate pulse: $I_G=2\text{ A}$ ;<br>$t_{GP}=50\text{ }\mu\text{s}$ ; $di_G/dt\geq 1\text{ A}/\mu\text{s}$  |
|                        |                                                                        |                  | 37.0<br>43.0                             | $T_j=T_{j\max}$<br>$T_j=25^{\circ}C$                                                                                                                     | 180° half-sine wave;<br>$t_p=8.3\text{ ms}$ ; single pulse;<br>$V_D=V_R=0\text{ V}$ ;<br>Gate pulse: $I_G=2\text{ A}$ ;<br>$t_{GP}=50\text{ }\mu\text{s}$ ; $di_G/dt\geq 1\text{ A}/\mu\text{s}$ |
| $I^2t$                 | Safety factor <sup>1)</sup>                                            | $A^2s\cdot 10^3$ | 6100<br>8000                             | $T_j=T_{j\max}$<br>$T_j=25^{\circ}C$                                                                                                                     | 180° half-sine wave;<br>$t_p=10\text{ ms}$ ; single pulse;<br>$V_D=V_R=0\text{ V}$ ;<br>Gate pulse: $I_G=2\text{ A}$ ;<br>$t_{GP}=50\text{ }\mu\text{s}$ ; $di_G/dt\geq 1\text{ A}/\mu\text{s}$  |
|                        |                                                                        |                  | 5600<br>7600                             | $T_j=T_{j\max}$<br>$T_j=25^{\circ}C$                                                                                                                     | 180° half-sine wave;<br>$t_p=8.3\text{ ms}$ ; single pulse;<br>$V_D=V_R=0\text{ V}$ ;<br>Gate pulse: $I_G=2\text{ A}$ ;<br>$t_{GP}=50\text{ }\mu\text{s}$ ; $di_G/dt\geq 1\text{ A}/\mu\text{s}$ |
| BLOCKING               |                                                                        |                  |                                          |                                                                                                                                                          |                                                                                                                                                                                                  |
| $V_{DRM}, V_{RRM}$     | Repetitive peak off-state and Repetitive peak reverse voltages         | V                | 4600...5200                              | $T_{j\min}<T_j<T_{j\max}$ ;<br>180° half-sine wave; 50 Hz;<br>Gate open                                                                                  |                                                                                                                                                                                                  |
| $V_{DSM}, V_{RSM}$     | Non-repetitive peak off-state and Non-repetitive peak reverse voltages | V                | 4700...5300                              | $T_{j\min}<T_j<T_{j\max}$ ;<br>180° half-sine wave; single pulse;<br>Gate open                                                                           |                                                                                                                                                                                                  |
| $V_D, V_R$             | Direct off-state and Direct reverse voltages                           | V                | $0.6\cdot V_{DRM}$<br>$0.6\cdot V_{RRM}$ | $T_j=T_{j\max}$ ;<br>Gate open                                                                                                                           |                                                                                                                                                                                                  |

| TRIGGERING         |                                                                      |              |             |                                                                                                                                                         |
|--------------------|----------------------------------------------------------------------|--------------|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| $I_{FGM}$          | Peak forward gate current                                            | A            | 10          | $T_j = T_{j\max}$                                                                                                                                       |
| $V_{RGM}$          | Peak reverse gate voltage                                            | V            | 5           |                                                                                                                                                         |
| $P_G$              | Gate power dissipation                                               | W            | 5           | $T_j = T_{j\max}$ for DC gate current                                                                                                                   |
| SWITCHING          |                                                                      |              |             |                                                                                                                                                         |
| $(di_T/dt)_{crit}$ | Critical rate of rise of on-state current non-repetitive ( $f=1$ Hz) | A/ $\mu$ s   | 630         | $T_j = T_{j\max}$ ; $V_D = 0.67 \cdot V_{DRM}$ ; $I_{TM} = 2 I_{TAV}$ ;<br>Gate pulse: $I_G = 2$ A;<br>$t_{GP} = 50 \mu$ s; $di_G/dt \geq 2$ A/ $\mu$ s |
| THERMAL            |                                                                      |              |             |                                                                                                                                                         |
| $T_{stg}$          | Storage temperature                                                  | $^{\circ}$ C | -60...+50   |                                                                                                                                                         |
| $T_j$              | Operating junction temperature                                       | $^{\circ}$ C | -60...+125  |                                                                                                                                                         |
| MECHANICAL         |                                                                      |              |             |                                                                                                                                                         |
| F                  | Mounting force <sup>1)</sup>                                         | kN           | 60.0...70.0 |                                                                                                                                                         |
| $F_{cg}$           | Force on control gate                                                | N            | 7.8         |                                                                                                                                                         |

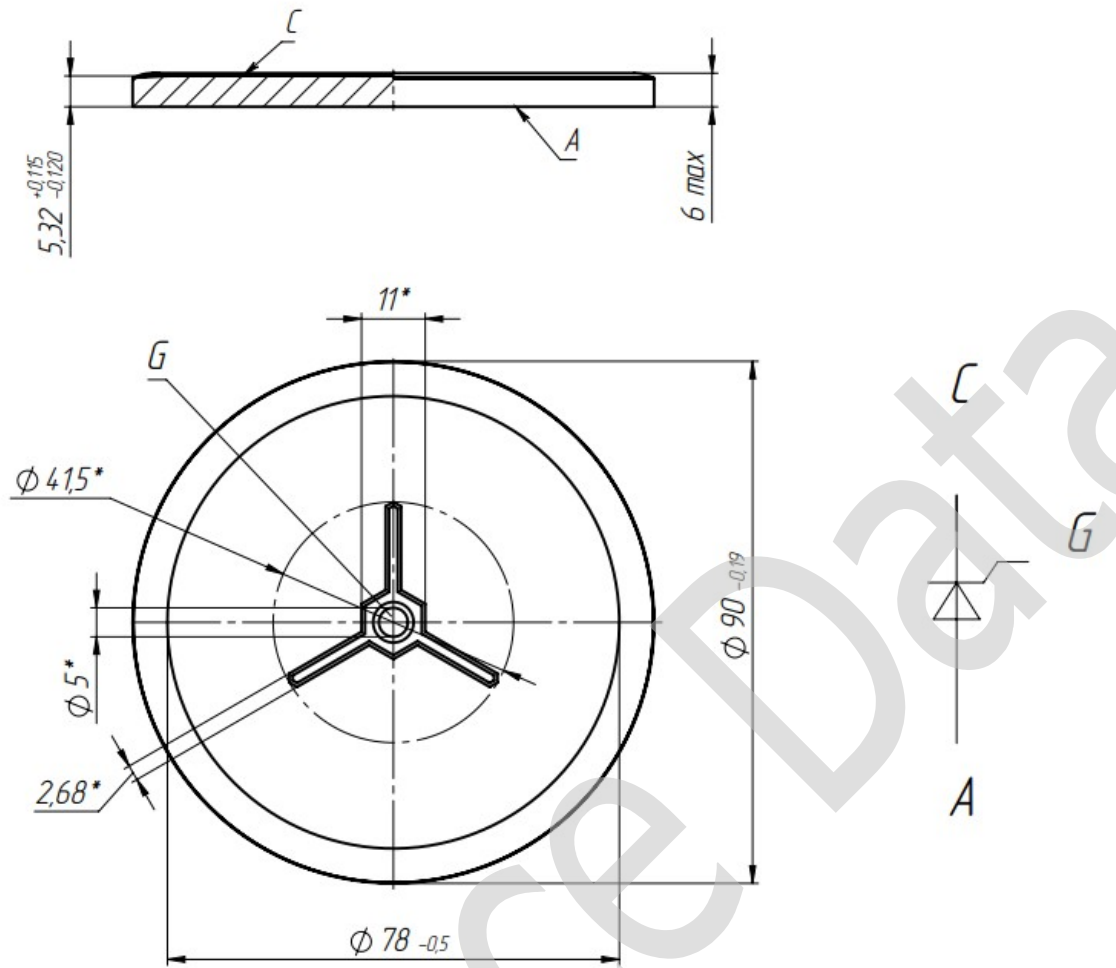
## CHARACTERISTICS

| Symbols and parameters |                                                                     | Units            | Values               | Conditions                                                                                                                                                                                                                                   |                                                               |
|------------------------|---------------------------------------------------------------------|------------------|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|
| ON-STATE               |                                                                     |                  |                      |                                                                                                                                                                                                                                              |                                                               |
| $V_{TM}$               | Peak on-state voltage <sup>1)</sup> , max                           | V                | 2.50                 | $T_j=25\text{ }^{\circ}\text{C}$ ; $I_{TM}=6300\text{ A}$                                                                                                                                                                                    |                                                               |
| $V_{T(TO)}$            | On-state threshold voltage, max                                     | V                | 1.00                 | $T_j=T_{j\text{ max}}$ ;                                                                                                                                                                                                                     |                                                               |
| $r_T$                  | On-state slope resistance <sup>1)</sup> , max                       | m $\Omega$       | 0.290                | $0.5\pi I_{TAV} < I_T < 1.5\pi I_{TAV}$                                                                                                                                                                                                      |                                                               |
| $I_L$                  | Latching current, max                                               | mA               | 1500                 | $T_j=25\text{ }^{\circ}\text{C}$ ; $V_D=12\text{ V}$ ;<br>Gate pulse: $I_G=2\text{ A}$ ;<br>$t_{GP}=50\text{ }\mu\text{s}$ ; $di_G/dt\geq 1\text{ A}/\mu\text{s}$                                                                            |                                                               |
| $I_H$                  | Holding current, max                                                | mA               | 300                  | $T_j=25\text{ }^{\circ}\text{C}$ ;<br>$V_D=12\text{ V}$ ; Gate open                                                                                                                                                                          |                                                               |
| BLOCKING               |                                                                     |                  |                      |                                                                                                                                                                                                                                              |                                                               |
| $I_{DRM}, I_{RRM}$     | Repetitive peak off-state and Repetitive peak reverse currents, max | mA               | 300                  | $T_j=T_{j\text{ max}}$ ;<br>$V_D=V_{DRM}$ ; $V_R=V_{RRM}$                                                                                                                                                                                    |                                                               |
| $(dv_D/dt)_{crit}$     | Critical rate of rise of off-state voltage <sup>2)</sup> , min      | V/ $\mu\text{s}$ | 500, 1000, 1600      | $T_j=T_{j\text{ max}}$ ;<br>$V_D=0.67\cdot V_{DRM}$ ; Gate open                                                                                                                                                                              |                                                               |
| TRIGGERING             |                                                                     |                  |                      |                                                                                                                                                                                                                                              |                                                               |
| $V_{GT}$               | Gate trigger direct voltage, max                                    | V                | 5.00<br>3.00<br>2.00 | $T_j= T_{j\text{ min}}$<br>$T_j=25\text{ }^{\circ}\text{C}$<br>$T_j= T_{j\text{ max}}$                                                                                                                                                       | $V_D=12\text{ V}$ ; $I_D=3\text{ A}$ ;<br>Direct gate current |
| $I_{GT}$               | Gate trigger direct current, max                                    | mA               | 500<br>300<br>200    | $T_j= T_{j\text{ min}}$<br>$T_j= 25\text{ }^{\circ}\text{C}$<br>$T_j= T_{j\text{ max}}$                                                                                                                                                      |                                                               |
| $V_{GD}$               | Gate non-trigger direct voltage, min                                | V                | 0.35                 | $T_j=T_{j\text{ max}}$ ;<br>$V_D=0.67\cdot V_{DRM}$ ;                                                                                                                                                                                        |                                                               |
| $I_{GD}$               | Gate non-trigger direct current, min                                | mA               | 15.00                | Direct gate current                                                                                                                                                                                                                          |                                                               |
| SWITCHING              |                                                                     |                  |                      |                                                                                                                                                                                                                                              |                                                               |
| $t_{gd}$               | Delay time, max                                                     | $\mu\text{s}$    | 4.00                 | $T_j=25\text{ }^{\circ}\text{C}$ ; $V_D=1500\text{ V}$ ; $I_{TM}=I_{TAV}$ ;<br>$di/dt=200\text{ A}/\mu\text{s}$ ;<br>Gate pulse: $I_G=2\text{ A}$ ; $V_G=20\text{ V}$ ;<br>$t_{GP}=50\text{ }\mu\text{s}$ ; $di_G/dt=2\text{ A}/\mu\text{s}$ |                                                               |
| $t_q$                  | Turn-off time <sup>3)</sup> , max                                   | $\mu\text{s}$    | 800                  | $dv_D/dt=50\text{ V}/\mu\text{s}$ ; $T_j=T_{j\text{ max}}$ ; $I_{TM}=I_{TAV}$ ;<br>$di_R/dt=-10\text{ A}/\mu\text{s}$ ; $V_R=100\text{ V}$ ;<br>$V_D=0.67 V_{DRM}$ ;                                                                         |                                                               |

| THERMAL             |                                                          |      |        |                |                     |
|---------------------|----------------------------------------------------------|------|--------|----------------|---------------------|
| R <sub>thjc</sub>   | Thermal resistance, junction to case <sup>1)</sup> , max | °C/W | 0.0065 | Direct current | Double side cooled  |
| R <sub>thjc-A</sub> |                                                          |      | 0.0143 |                | Anode side cooled   |
| R <sub>thjc-K</sub> |                                                          |      | 0.0117 |                | Cathode side cooled |
| MECHANICAL          |                                                          |      |        |                |                     |
| m                   | Weight, max                                              | g    | 375    |                |                     |

| PART NUMBERING GUIDE                                    |    |      |    |    |    | NOTES                                                                                                                                    |
|---------------------------------------------------------|----|------|----|----|----|------------------------------------------------------------------------------------------------------------------------------------------|
| TG                                                      | 90 | 2000 | 52 | A2 | B2 | 1) Depending on the specifications of the housing used. The specified values are relevant when using the Proton-Electrotex T.H1 housing. |
| 1                                                       | 2  | 3    | 4  | 5  | 6  |                                                                                                                                          |
| 1. Phase Control Thyristor Chip with a distributed gate |    |      |    |    |    | 2) Critical rate of rise of off-state voltage                                                                                            |
| 2. Maximum diameter, mm                                 |    |      |    |    |    |                                                                                                                                          |
| 3. Mean on-state current, A                             |    |      |    |    |    | 3) Turn-off time (dv <sub>D</sub> /dt=50 V/μs)                                                                                           |
| 4. Voltage code                                         |    |      |    |    |    |                                                                                                                                          |
| 5. Critical rate of rise of off-state voltage, V/μs     |    |      |    |    |    | Symbol of group                                                                                                                          |
| 6. Turn-off time (dv <sub>D</sub> /dt=50 V/μs)          |    |      |    |    |    |                                                                                                                                          |
|                                                         |    |      |    |    |    | A2                                                                                                                                       |
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## OVERALL DIMENSIONS



*\*Dimensions for reference.*

All dimensions in millimeters

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In the interest of product improvement, Proton-Electrotex reserves the right to change data sheet without notice.